Severe periodontitis is more common in HIV- infected patients

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Keywords: HIV infection, periodontitis, prevalence

Introduction

Periodontitis is an inflammatory disease of the tissues supporting the teeth caused by specific microorganisms or groups of specific microorganisms. This inflammation results in a progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession or both [1]. The prevalence of chronic periodontitis in the general population is approximately 30%. Severe generalized periodontitis is present in 5-15% of the population worldwide and is considered a major cause of tooth loss [2-4]. Moreover, periodontitis is linked to an increased risk of age-related diseases, such as cardiovascular diseases, auto-immune diseases and diabetes mellitus [5].

Periodontitis is strongly associated with human immunodeficiency virus (HIV) infection [6-8]. Patients with HIV infection who already have periodontitis appear to have a higher risk of aggravation of their periodontitis [9-11]. The exact role of HIV infection in the progression of periodontitis is, however, not yet clear [10,11]. HIV infected patients are also at higher risk of developing age-related diseases [12]. It is unknown whether an interaction between HIV infection and periodontitis increases this risk.

Prevalence of periodontitis in HIV infected patients before the introduction of combination antiretroviral therapy (cART) ranges from 51% in a British study to 62% in a study in the USA [13,14]. After the introduction of cART, the reported prevalence of periodontitis in HIV infected patients varied even more widely. For instance, in a study in India among 130 HIV infected patients, a prevalence of periodontitis of 20% was found [15] while a very small study (n=29) in Brazil reported a prevalence of 86% [16]. This variation can be explained by the different definitions used in the studies [17,18], differences in social and economic status [19] as well as the availability of dental care and oral care awareness and the attitudes of dental practitioners [20].

Nowadays, HIV infection has become a chronic disease with a nearly normal life expectancy [21]. Mortality of HIV infected patients mainly results from non-HIV associated age-related diseases. Therefore, the emphasis of HIV treatment and management has shifted towards prevention of cardiovascular disease and lifestyle interventions and includes early initiation of cART regimens with the fewest metabolic adverse effects [22]. Data on the current prevalence and severity of periodontitis in HIV infected patients in resource-rich settings is lacking. As dental care is currently not an integrated part of HIV treatment, knowledge on the prevalence of periodontitis, its sequelae (tooth loss, and potential induction of cardiovascular disease) and modifiable risk factors could have a significant impact on oral and overall health of HIV infected patients.

Therefore, the primary aim of this study was to assess the prevalence and severity of periodontitis in a representative sample of the HIV-infected population of the Netherlands, treated with cART, as compared to a control group from the same area. The secondary aim was to analyze whether patient characteristics, i.e. HIV infection characteristics, presence of age-related diseases, and oral health care characteristics, were associated with the severity of the periodontal disease.

Patients and Methods

Patients

Consecutive HIV infected patients were recruited at our outpatient clinic, at the University Medical Center, Groningen, the Netherlands between May and December 2015. Inclusion criteria for patients with HIV infection were ≥18 years of age and presence of ≥6 teeth. Exclusion criteria were history of radiation therapy in the head and neck region and inability to understand Dutch or English. The ethics committee of the University Medical Center Groningen (METc number 2014/128) approved this study.

For comparison of the periodontal status of HIV-infected patients with that of historical controls, data from a previously described study were used [23]. These historical controls (n=539) were patients randomly selected from a private dental practice located in the north of the Netherlands, the same geographic area where the HIV infected patients reside.

Methods

All included patients underwent a full-mouth periodontal examination by an experienced dental hygienist. Pocket probing depth was measured at six sites per tooth on all teeth with a manual periodontal probe (Williams probe 14 W, Hu-Friedy Mfg. Co., LLC, UK). Prevalence and severity of periodontitis were assessed using the Dutch Periodontal Screening Index (DPSI) [24] comparable to the internationally used CPITN [25]. Severity of periodontitis is measured by probing the depth of the crevice between the root and gum. Normally, this depth does not exceed 3mm (DPSI or CPITN 0-2), a 4-5 mm probing pocket depth indicates mild periodontitis or gingivitis (DPSI or CPITN 3), while a depth of 6 mm or more indicates severe periodontitis (DPSI or CPITN 4). All included patients completed a health and oral care assessment questionnaire to identify additional medical conditions that might be associated with periodontitis, such as diabetes and cardiovascular diseases[26-28]. Age, ethnicity, body mass index (BMI), sex, and

smoking were recorded as potential determinants of periodontitis [29]. Patients were also asked how often they visited their dentist and whether they had informed their dentist about their HIV infection. Furthermore, the oral health care habits of the patients were noted (e.g. brushing frequency, type of tooth brush, interdental cleaning, etc.).

Data were collected from medical charts of patients with HIV infection regarding the mode of transmission, number of years with HIV infection, type of cART, current CD4+/CD8+ ratio, CD4+ nadir, viral load and Centers for Disease Control and Prevention (CDC) classification [30]. Patients were classified as having 'immune activation' if the CD4+/CD8+ was ≤1.0 and as having 'no immune activation' if the CD4+/CD8+ was >1.0 [31]. CD4+ nadir (lowest CD4 ever recorded) was categorized as <200, 200-500, and ≥500 cells/mm^3 [30]. Viral load measurement was performed on EDTA plasma samples using Abbott Real-Time HIV 1 assay and categorized as high (>1000 copies/mL), low (>40-1000 copies/mL) or undetectable (≤40 copies/mL) [32,33]. Patients were classified according to the 'Revised Surveillance Case Definition for HIV Infection' in three stages, according to the CD4+ T-lymphocyte count or presence of opportunistic illness [34].

Data missing from the patient chart were completed by searching the database of the HIV monitoring Foundation (SHM), the national executive organization for registration and monitoring of consenting patients with HIV infection who are registered for care in the 27 HIV treatment centers in the Netherlands [35].

Statistical analysis

Differences between HIV infected patients and controls were analyzed using univariate analyses (independent sample t test or, χ^2 test as appropriate). To statistically predict the risk of periodontitis in HIV infected patients and control group, a logistic regression analysis was performed with HIV (HIV infected=1), sex (male=1), age in years, diabetes (1=present), cardiovascular disease (1=present) and smoking (1=yes), as potential risk factors. All risk factors were entered in the regression model and removed if the significance of the regression coefficient was >0.10. Thereafter, interaction terms were explored. Within the group of HIV infected patients, potential risk factors of severity of periodontitis (age, sex, body mass index (BMI), smoking, plaque score, number of teeth, ethnicity, and other medical conditions, mode of HIV transmission, years of HIV infection and type of cART medication) were tested for significance using univariate analyses. Statistical analysis was performed with IBM SPSS Statistics 23 (SPSS, Chicago, IL, USA).

Results

Of the 731 patients registered with HIV 1 infection at our outpatient clinic, 471 patients visited the clinic between May and December 2015 for a routine appointment. Of these 471 patients, a total of 258 patients were included (Figure 1;Table 1; Table 2). No significant differences in gender, age, smoking, prevalence of diabetes and cardiovascular diseases were detected between the group of patients with HIV infection included in this study and the group of all registered HIV patients of the Department. Thus, the included group of patients with HIV infection was a representative subgroup of all registered 731 registered patients with HIV in Groningen (Table 3).

Prevalence of periodontitis

Prevalence of severe periodontitis was higher in HIV infected patients as compared to controls (pocket depth ≥6mm, which is compatible with DPSI 4: 64.7% versus 35.8.%; $p<0.001$; Table 4). When patients with HIV infection were classified according to DPSI score, 34% of them had DPSI 3 and 66% of them DPSI 4. Logistic regression analysis revealed that HIV infection, age, gender and the interaction term age x age were significant risk factors for periodontitis, i.e., HIV infected patients had a higher risk for severe periodontitis than controls; older patients had higher risk for severe periodontitis until the age of approximately 55; thereafter the risk declined (Table 5). Male patients had a higher risk of developing severe periodontitis than female patients (Table 5). Other interaction terms were not significantly associated with periodontitis. Based on the regression outcomes, the risk for periodontitis was calculated (Figure 2): in all groups, the risk of having periodontitis gradually increased until the age of approximately 55 and declined thereafter. Patients with HIV infection were not developing periodontitis at younger age than controls.

cART, clinical, immunological and virological characteristics

Clinical, immunological and virologic characteristics as well as type of cART were not associated with DPSI scores (Table 6). The number of smoking units per day was significantly higher in HIV infected patients with DPSI 4 compared to those with DPSI 3 (4.9 vs 2.0 smoking units/day, $p<0.05$.)

Oral healthcare routine

When HIV infected patients were classified according to DPSI score, the frequency of tooth brushing and use of interdental cleaning did not differ significantly between them. The questionnaire results showed that 44% of the patients did not inform their dentist about their HIV infection. Disclosure of HIV infection to the dentist was, however, not associated with DPSI score (Table 7). All patients, independently of their DPSI score, rated the importance of their dental health as very high (VAS=9) (Table 7).

Discussion

In our study the prevalence of severe periodontitis in patients with HIV infection was 66%, almost twice as high as in uninfected controls. Our results are in line with the prevalence of severe periodontitis found in HIV-infected patients in London, United Kingdom in the pre-cART era: 60% compared to 29% in controls [13]. In a more recent German study, however, the prevalence of severe periodontitis in HIV infected patients was considerably lower, i.e. 30% [18], although the latter study did not specify any definition of severe periodontitis, making it impossible to compare both results. Moreover, with the exception of the aforementioned study by Robinson et al. [13], none of the studies included a comparable control group, hampering any conclusions on periodontitis prevalence and severity in HIV patients as compared to controls.

Gender, age, the interaction term age x age and HIV infection, were the risk factors of severe periodontitis in the statistical analysis. Interestingly, we detected that the risk of severe periodontitis increased till the age of approximately 55 years and declined thereafter. This trend is in contrast to the general perception that the prevalence of severe periodontitis continuously increases with age [36]. As age increases, teeth may be lost due to severe periodontitis, thus masking an increasing prevalence of severe periodontitis with age [37]. Moreover, with increasing age, dentists may be more prone to remove teeth affected by severe periodontitis. As tooth loss in elderly patients is often considered a natural process, this shift in attitude towards extraction of teeth may also mask an increasing prevalence of periodontitis with age. Another explanation might be that the statistical model used in our study did not precisely estimate the risk of severe periodontitis in older ages due to the limited number of participants older than 65.

HIV-infected men appear to have a higher risk of developing severe periodontitis than HIV-infected women. This finding is in accordance with a previous study in HIV infected patients in Brazil where the prevalence of periodontitis was 30% for men and 20% for women [19]. In general the cause of gender differences in the prevalence of periodontitis is not fully understood. It is postulated that oral hygiene level in males is poorer than in females or that hormonal,

physiological and behavioral differences, for instance more males smoke than females, may play a role [2,38]. Interestingly, we found that HIV-infected women had the same prevalence of severe periodontitis as male HIV-uninfected controls.

Our study shows that HIV-infected patients rate the importance of their oral health as very high, but many HIV infected patients do not inform their dentists about HIV infection. This failure to inform their dentist could be due to several factors. Fear of refusal of dental treatment or fear of stigmatization are probably the most common reasons for not disclosing HIV infection [20]. Indeed, dentists' concerns regarding increased personal risk is the most frequently reported reason for their reluctance to treat HIV-infected patients [39]. Increased awareness of healthcare professionals about the higher prevalence of periodontitis in HIV-infected patients and could significantly improve oral health and thus the quality of life of HIV-infected patients.

Patients with HIV infection are known to have a significantly higher prevalence of age-associated diseases, like hypertension, diabetes mellitus, obstructive pulmonary disease and renal dysfunction [40]. It is postulated that the increased prevalence of cardiovascular diseases in HIV patients is due to activation of the immune system. Specifically, macrophages and monocytes activation, which play a significant role in atherogenesis, in combination with deregulation of CD8+ T-cells, are associated with higher values of carotid intimal media thickness and arterial stiffness [41] Likewise, HIV and periodontitis could interact and promote development of age-associated diseases [23,42]. We could not confirm that diabetes and cardiovascular diseases were significant risk factors for periodontitis in our HIV-infected patients, however. Further exploration of the relationship between periodontitis and HIV-related immune activation as a prognostic determinant of age-associated diseases is desirable.

Smoking is strongly and consistently associated with periodontitis in the general population [43] In our study we detected a similar pattern in patients with HIV infection: smokers had a higher DPSI score compared to non-smokers. The exact cause of smoking as a risk factor for periodontitis in the general population is still unclear. Smoke components may impair the innate

immune system against pathogens, alter antigen presentation and modulate the adaptive immune response [44,45]. In other studies periodontitis was also more prevalent in smoking compared to non-smoking HIV-infected patients [16,19].

Finally, in our study we found no association between oral care characteristics, BMI, mode of HIV transmission, years of infection and type of cART with severity of periodontitis (DPSI 4). This lack of association could be attributed to the use of DPSI. DPSI can categorize patients into 3 groups: patients without periodontitis, with mild or with severe periodontitis, but does not quantify the severity of periodontitis in more detail. Future studies quantifying the severity of periodontitis as a continuous variable should shed more light on these issues.

The major strength of our study is the complete and refined data collection for all patients, i.e., thorough medical history recording and detailed documentation of oral health characteristics, as well as comprehensive registration of immunological and virologic values. Additionally, the broad inclusion of patients may allow the generalization of our findings in similar Western European populations. Limitations, however, also apply. In the group of HIV infected patients, DPSI was applied to score presence of severe periodontitis (DPSI≥ 3+), while in controls presence of severe periodontitis was based on presence of pocket depths ≥6mm after full mouth periodontal probing. Since DPSI≥ 3+ corresponds to presence of pocket depths ≥6mm, we considered that the applied cut-off values (DPSI≥ 3+ and pocket depth ≥6mm) for presence of severe periodontitis are comparable. In our group of HIV infected patients 85% is male, which is in agreement with the gender distribution of HIV infected patients in Groningen and the Netherlands (81% male, table 3)[46]. Furthermore, we applied questionnaires to assess the presence of general health issues instead of specific blood tests for underlying diseases as, e.g., diabetes mellitus. Consequently, patients might not have reported a disease, either because they did not mention it or were not aware of it yet, which may have resulted in underestimation of prevalence of health issues in our patient and control cohort. Additionally,

we did not specify the type of cardiovascular diseases, but we only registered their presence. However, the use of questionnaires to assess general health is a rather common approach [47].

Conclusion

Prevalence and severity of periodontitis are higher in patients with HIV infection as compared to controls, particularly in older males. Awareness of the increased prevalence of periodontitis associated with HIV infection among patients and health-care professionals could significantly improve oral health and thereby the quality of life of HIV-infected patients.

Therefore, in order to preserve oral health and high quality of life, HIV patients should be routinely referred to oral health specialists by their treating physicians.

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Conflicts of interest

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Figure 1: Flowchart of the recruitment of patients with HIV-1 infection to be included in the study.

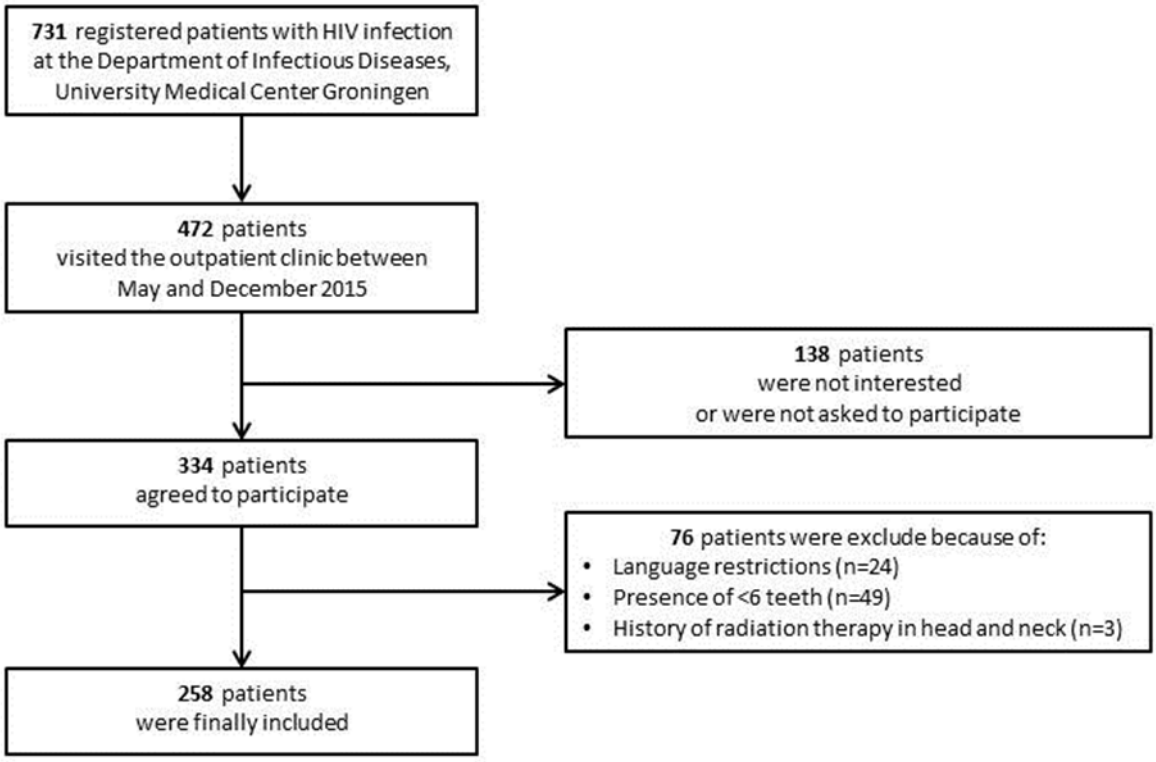
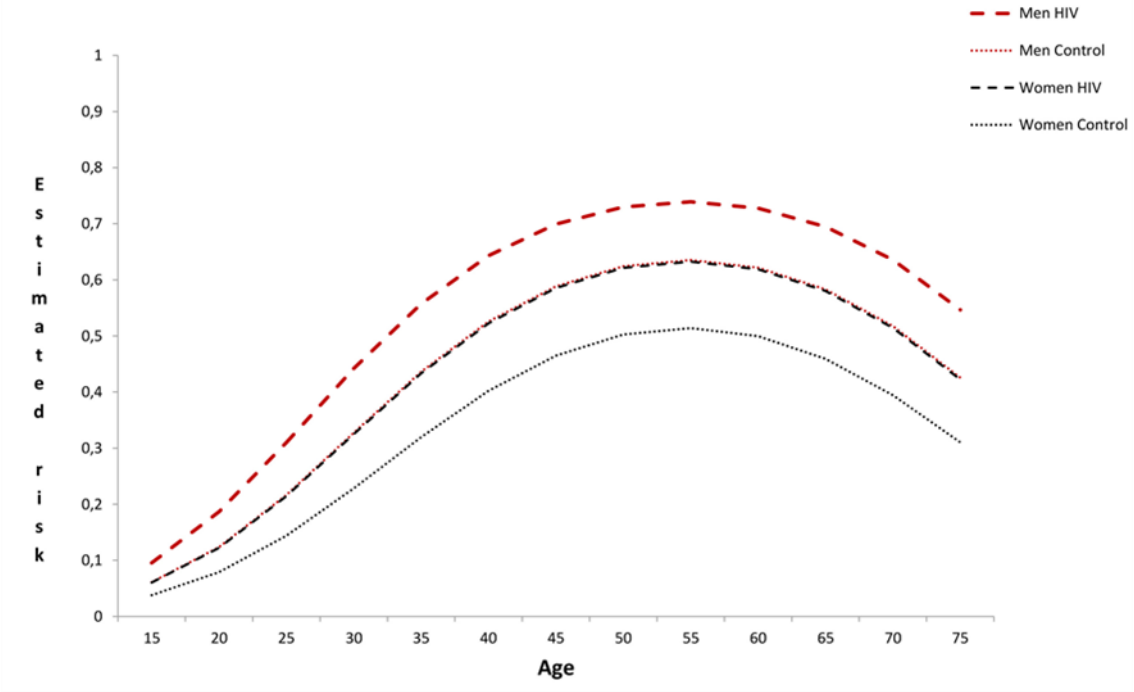


Figure 2: Risk for periodontitis in HIV-infected patients and controls based on the results of the logistic regression analysis.



Note: the curve for male controls matches the curve for females with HIV.

Table 1: Patient and dental related characteristics of the 258 patients with HIV-1 infection.

		Mean (SD)
Age (years)		48.2 (11.0)
Weight (kg)		78.7 (12.7)
Height (cm)		179.6 (9.3)
BMI male*		23.9 (3.2)
BMI female		27.1 (5.6)
		N (%)
Gender	Male	219 (84.9)
Diabetes	Yes	14 (5.4)
Cardiovascular diseases	absent	184 (79.7)
	present	47 (20.3)
	unknown	27 (10.5)
Tobacco use	Yes	93 (36.0)
	No	95 (36.8)
	Former smokers	70 (27.1)
Ethnicity	Africa	35 (13.6)
	Antarctica	0
	Asia	2 (0.8)
	Europe	209 (81.0)
	North America	10 (3.9)
	Australia	0 (0)
	South America	2 (0.8)
The patient visits the dentist	No	28 (10.9)
	Yes	195 (75.6)
	Yes, only in case of problems	35 (13.6)
The dentist is informed about the HIV/AIDS infection**	No	102 (44.3)
DPSI	DPSI 0	0 (0)
	DPSI 1	0 (0)
	DPSI 2	1 (0.39)
	DPSI 3-	48 (18.6)
	DPSI 3+	40 (15.5)
	DPSI 4	169 (65.5)

*BMI (Body Mass Index) was a significant different between male and female patients with HIV-1 infection ($P<0.05$) ** in case of the 229 patients who visit the dentist ;1 answer was missing

Table 2: HIV related characteristics of the 258 patients with HIV-1 infection.

		N (%)
Mode of HIV transmission	Homosexual sex	162 (62.8)
	Heterosexual sex	65 (25.2)
	Bisexual sex	14 (5.4)
	Blood transfusion or unknown	17 (6.6)
Type of cART	No medication	5 (1.9)
	PI-based	79 (30.6)
	NNRT-based	111 (43.0)
	INI-based	45 (17.4)
	Other	18 (7.0)
Viral load	Undetectable	224 (86.8)
	Low Level	19 (7.4)
	High Level	15 (5.8)
CD4+ nadir	<200*** cells/mm^3	99 (38.4)
	200-<500 cells/mm^3	119 (46.1)
	>500 cells/mm^3	32 (12.4)
CD4/CD8	immune activation	167 (64.7)
	No immune activation	91 (35.3)
CDC classification	Stage 1	32 (12.4)
	Stage 2	107 (41.5)
	Stage 3	119(46.1)
		Median (IQR)
CD4+ (cells/mm^3)		610.0 [440.0;760.0]
CD4+/CD8+		0.8 [0.6;1.1]
CD4+ nadir (cells/mm^3) *		230.0 [110.0;330.0]
Duration of infection (years)		8.5 [4.7;13.4]

*: CD4+ nadir was not known in 8 patients, due to incomplete patient charge

Table 3: Comparison of patients with HIV-1 infection included in this study with the group of registered patients at the Department of Infectious Diseases of the University Medical Center Groningen, Groningen, the Netherlands.

		HIV-1-infected patients included in this study	**All registered patients with HIV-1 infection in Groningen**
Number		258	731
Male (N, %)		219 (85)	592 (81)
Age (years, %)	18-≤24	5 (1.9)	11 (1.5)
	25≤34	23 (8.9)	76 (10.4)
	35≤44	69 (26.7)	154 (21.1)
	45≤54	92 (35.7)	226 (30.9)
	55≤65	48 (18.6)	169 (23.1)
	>65	21 (8.1)	79 (10.8)
Smoking (N, %)	Yes	93 (36.0)	192 (30.1)
	No	95 (36.8)	291 (45.7)
	Former smoker	70 (27.1)	154 (24.2)
Diabetes (%)		14 (5.4)	85 (11.6)
Cardiovascular diseases (%)		47 (20.3)	99 (13.5)

Table 4: Characteristics of in the HIV-infected patients and the controls.

Characteristics	**HIV infected Patients (n=258)**	**Controls (n=539)**	**P Value**
Male N (%)	219 (85)	256 (47.5)	<0.001
Age Mean (sd)	48.2 (11.0)	36.4 (12.1)	<0.001#
Periodontitis N (%)$	167(64.7)	193(35.8)	<0.001
Smoking N (%)	163 (63.2)	80 (30)*	<0.001
Diabetes N (%)	14 (5.4)	17 (3.2)**	0.169
Cardiovascular diseases N (%)	47 (20.3)	13 (2.4)***	<0.001

# 95% conference interval:10.0-13.5, results of t-test for independent samples, all other results were derived from Chi-square test
$ pocket depth ≥6 and/or DPSI
* data available in 268 patients
** data available in 558 patients
*** data available in 512 patients

Table 5: Results of logistic regression analysis to predict periodontitis in HIV-infected groups and controls based on gender age and HIV infection.

	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Gender	0.499	0.170	0.003	1.647	1.181	2.296
Age	0.228	0.039	<0.001	1.256	1.164	1.356
HIV-infected	0.487	0.185	0.008	1.627	1.133	2.336
Age x Age	-0.002	0.0004	<0.001	0.998	0.997	0.999
Constant	-6.183	0.844	<0.001	0.002		

Reference groups are females and controls

Table 6: Characteristics of patients with HIV-1 infection, classified according to DPSI* (the one patient with DPSI 2 is not shown).

		DPSI 3-	DPSI 3+	DPSI 4	P value
Total, N (%)		48 (18.6)	40 (15.5)	169 (65.5)	
Male, N (%)		39 (81.3)	32 (80.0)	148 (87.6)	0.350
Age, mean (SD)		44.4(13.2)	49.6(11.0)	48.9(10.1))	0.028
BMI, mean (SD)		24.4(3.1)	24.3(3.9)	24.5(4.0)	0.981
Diabetes, N (%)	No	45(93.8)	37(92.5)	162(95.9)	0.636
	Yes	3 (6.3)	3 (7.5)	7 (4.1)	
Cardiovascular diseases, N (%)	No	36 (81.8)	28 (75.7)	120 (80.5)	0.787
	Yes	8 (18.2)	9 (24.3)	29 (19.5)	
Use of tobacco, N (%)	No	26 (54.2)	9 (22.5)	59 (34.9)	0.022
	Yes	10 (20.8)	17 (42.5)	66 (39.1)	
	Former-smoker	12 (25.0)	14 (35.0)	44 (26.0)	
CDC classification, N (%)	Stage 1	5 (10.4)	5(12.5)	22(13.0)	0.766
	Stage 2	24 (20.0)	17(42.5)	66 (39.1)	
	Stage 3	19 (39.6)	18 (45.0)	81(47.9)	
CD4/CD8	immune activation	33(68.8)	24(60.0)	109(64.5)	0.692
	No immune	15(31.1)	16(40.0)	60(35.5)	
CD4+ nadir (%)	<200 cells/mm^3	17 (35.4)	13 (36.1)	68 (41.2)	0.888
	200-500 cells/mm^3	25 (52.1)	17 (47.2)	77 (46.7)	
	≥500 cells/mm^3	6 (12.5)	6 (16.7)	20 (12.1)	
Viral Load (%)	Undetectable	42 (87.5)	35 (87.5)	146 (86.4)	0.943
	<1000 copies/mL	4 (8.3)	2 (5.0)	13 (7.7)	
	≥ 1000 copies/mL	2 (4.2)	3 (7.5)	10 (5.9)	
Type of cART, N (%)	No medication	1(2.1)	0(0.0)	4(2.4)	0.254
	PI-based	17 (35.4)	16 (40.0)	45 (26.6)	
	NNRT-based	22 (45.8)	14 (35.0)	75 (44.4)	
	INI-based	8(16.7)	5 (12.5)	32 (18.9)	
	Other	0 (0.0)	5 (12.5)	13 (7.7)	
Mode of transmission	MSM	33(68.8)	25(62.5)	118(69.8)	0.373
	Heterosexual	14(29.2)	10(25.0)	40(23.7)	
	Blood & otherwise	1(2.1)	5(12.5)	11(6.5)	

*Differences in DPSI were tested with Pearson Chi square test or one-way ANOVA

Table 7: Dental care characteristics of patients with HIV-1infection classified according to DPSI* (the one patient with DPSI 2 is not shown).

		DPSI 3-	**DPSI 3+**	**DPSI 4**	**P value**
Patient reported importance of dental health (VAS)Med (IQR)		9(8-10)	9(8-10)	9(8-10)	0.776
The patient visits the patient regularly (%)	Yes	34 (70.8)	33 (82.5)	127 (75.1)	0.289
	Yes, only in case of problems	5(10.4)-	4 (10.0)	26 (15.4)	
	No	9 (18.8)	3 (7.5)	16 (9.5)	
The dentist is aware of the HIV-infection (%) **	Yes	22 (56.4)	21 (56.8)	83 (54.6)	0.883
	No	17 (43.6)	16 (43.2)	69 (45.4)	
Periodontal treatment in the past (%)	Yes	14 (29.2)	17(42.5)	78 (46.2)	0.110
	No	34 (70.8)	23 (57.5)	91 (53.8)	
Frequency of tooth brushing (%)	Not daily	1(2.1)	0 (0.0)	7 (4.2)	0.803
	Daily	9 (18.8)	8 (20.0)	38 (22.8)	
	Twice per day	31 (64.6)	28 (70.0)	103 (61.7)	
	More than twice per day	7 (14.6)	4 (10.0)	19 (11.4)	
Type of tooth brush (%)	Electric	11 (25.0)	11 (31.4)	61 (18.4)	0.194
	Manual	27 (61.4)	20 (57.1)	68(43.0)	
	Both	6 (13.6)	4 (11.4)	29 (18.4)	
Interdental cleaning(%)	Yes	37 (77.1)	37 (92.5)	141 (83.4)	0.153
	No	11 (22.9)	3 (7.5)	28 (16.6)	
Full and/or partial dentures (%)	Yes	5 (10.4)	5 (12.5)	23(13.6)	0.892
	No	43 (89.6)	35 (87.5)	146 (86.4)	

*Differences in DPSI were tested with Pearson Chi square test or one-way ANOVA

** This question was applicable only for patients who stated to visit a dentist